JAN 13 1944

Statistical Bulletin

METROPOLITAN LIFE INSURANCE COMPANY

Volume 24 NOVEMBER 1943 *Number 11*

Robert Koch and the Conquest of Tuberculosis

ON DECEMBER 14TH of this year the world commemorates the 100th anniversary of the birth of Robert Koch, whose scientific contributions inaugurated a new era in medical research and public health practice. This pioneer contributed much to human welfare, but his greatest gift was the discovery and isolation of the tubercle bacillus, the cause of tuberculosis.

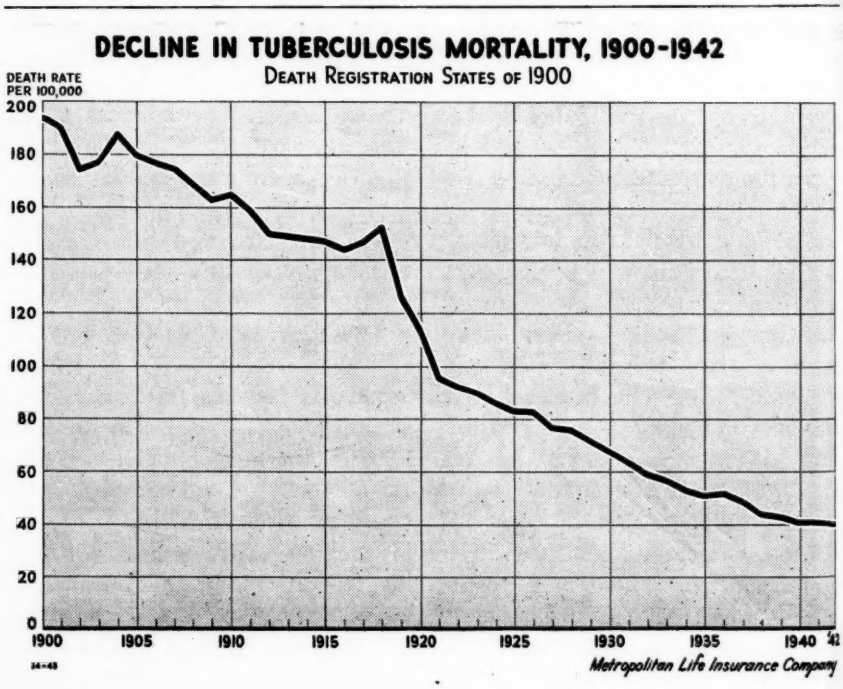
Robert Koch was barely past 38 when on March 24, 1882, he announced his discovery before the Physiological Society of Berlin. Even the most skeptical in that distinguished audience were convinced by Koch's flawless experimental technique and close cycle of reasoning. He reported that he had found the tubercle bacillus present in all cases of the disease; that he had isolated it from the human body, and had grown it in pure culture; that with this pure culture he had been able to give the disease to healthy animals, and in turn obtained the microbe from the animals so inoculated. These four postulates of proof definitely established the character of the tuberculosis organism; they have, moreover, remained the four essentials in bacteriological procedure since that time.

With this discovery Koch gave to medicine a sure technique for investigating the disease and for putting his findings into practical use. He showed that tuberculosis was not an inherited disease but an infection that spread from man to man; that it could be controlled by isolating known cases and by developing a population fortified against the disease by sound health. Through these two avenues of attack, the medical and public health agencies in Europe, and especially in the United States, have developed an extraordinarily effective campaign, successful far beyond the dreams of its founders.

The movement in this country was given great impetus through the work of three men: Dr. Hermann M. Biggs, who established the first health laboratory in New York; Dr. Edward L. Trudeau, who worked out new methods of care in his sanatorium at Saranac Lake; and Sir Robert Philip, of Edinburgh, who helped to create an effective procedure in the mass handling of tuberculosis as a community health

problem. To spread the program widely, the National Tuberculosis Association was organized in 1904 Physicians were trained in the diagnosis and care of the disease. A widespread and effective program of education has taught the public how the disease spreads, how to protect oneself against infection, and how to build up resistance through better personal hygiene. Tuberculosis clinics are now found in virtually every community throughout the country, and aid in discovering cases while they are still in the early and curable stages. More than two million people have been cared for in tuberculosis sanatoria in the last three decades. Many of these patients have been discharged with their disease cured or arrested, and have returned to productive work; more advanced patients who could not be restored to working capacity have profited from the care they received and have learned how to keep their infection from others.

The benefits that have flowed directly out of Koch's work and that of his successors have been phenomenal. The accompanying chart is a graphic portrait of the gains achieved. The tuberculosis death rate has dropped from around 200 per 100,000 at the turn of the century, to about 40 per 100,000 at present, a decline of 80 percent. Forty years ago tuberculosis was the leading cause of death by a wide margin; at present, the disease ranks in eighth place. In large sections of the population tuberculosis has



already become a relatively minor cause of death. Twelve States in widely scattered parts of our country show death rates under 30 per 100,000, which means that they have largely solved the problem of tuberculosis for their people. There are only a few States where the disease still presents a major public health hazard. A particularly fortunate aspect of the current situation is the continued improvement in the rates of mortality and morbidity, in spite of the hardships and dislocations resulting from the war.

From the viewpoint of life conservation, it is important to note that the greatest gains from tuberculosis mortality have been achieved at the younger productive ages of life, where the disease used to record its highest death rates. The experience of the many millions of Metropolitan Industrial policyholders is typical of the record for urban wage-earners and their families in this country. In 1911, tuberculosis among these insured accounted for almost two out of every five deaths among white men in the age group 25 to 44; among white women at these ages the ratio was one in three. Currently, only one eighth of the deaths at these ages result from tuberculosis. The death rate from this cause among white men has been reduced to about one sixth, and among women to less than one seventh, of the level prevailing 30 years ago.

To carry Koch's work to fruition, effort should be concentrated on those few groups, especially the Negro population, where tuberculosis is still strongly intrenched. Through the application of the same practices which have proved so effective, the White Plague can be rooted out of all sections of the population. The means are now at hand to eradicate tuberculosis from the mortality record of this country and to close another illustrious chapter in the history of public health.

The Cost of Bringing Up a Child

THIS is the fourth and concluding article in a series dealing with the cost of raising a child in American families which have an average income of $2,500 a year.

The various types of expenditures to care for the child from birth up to age 18 on the basis of the price level in 1935–1936 are summarized in the following table.

1. Cost of being born		$300.00
2. Food		2,271.88
3. Clothing and shelter		3,357.33
Clothing	$709.53	
Shelter	2,647.80	
4. Education		82.50
5. Medical care		296.84
6. Transportation and recreation		1,126.80
7. Sundries		326.52
TOTAL		$7,761.87

The major items of expense have already been discussed in previous issues of the BULLETIN, and now only brief attention need be given to the residual expenditures. Unlike most of the other items considered hitherto, the main expenditure for education does not figure directly in the family budget. According to the American system of public education, parents in the medium income group contribute comparatively little directly toward the education of their children, although they do, of course, share the expense through indirect taxation. The family budget covers only incidental costs which amount, on the average, to $82.50 for the years at school.

Medical care plays a relatively minor role in the cost of rearing the *average* child in families of $2,500 annual income. Up to age 18, medical and dental care come to approximately $300, or about the same as the cost of being born. It should be noted, however, that these are the costs borne directly by the parents of each child and, as in the case of education, the figures do not take into account the many valuable health services provided by the community for which there is no direct charge.

It may surprise many readers that expenditures for transportation and recreation come to a figure in excess of $1,100. This sum, like that for shelter, has been computed by taking the amount spent by the family for these items and charging the growing child with one fifth of the total. A large part of these expenditures arise out of the purchase and running of the family automobile.

Finally, there is a group of sundry expenditures which come to $327 for the 18 years. These miscellaneous expenses include the cost of personal care, newspapers and magazines, Life insurance, and a number of other items.

Summarizing our discussion thus far, we find that the expenditures for raising a child to age 18 by parents in the $2,500 income group average around $7,760. The difference in the amounts for boys and girls is relatively small and may therefore be disregarded.

There are several additional points to be considered. Allowance must be made for the fact that not all children born survive to age 18. Out of 100,000 children born, only 93,787 survive to adolescence under present conditions of mortality; the other 6,213 die before reaching their 18th birthday. Parents nevertheless must bear the cost of birth and partial rearing of the children who die prematurely. The situation is analagous to that of a manufacturer who, in figuring the cost of goods actually placed on the market, must include a charge for a certain amount of spoilage. The amount which must be charged, on the average, for this item of mortality, as shown in the table on page 5, totals $98 for each survivor to age 18. The corresponding mortality cost about two decades ago was more than twice the present figure, because of the higher death rate then prevailing.

There is also the matter of interest

on the money expended in bringing up a child. From a purely economic point of view, if the money spent had been invested it would have yielded interest earnings. From this standpoint, interest is a proper charge in the cost of rearing a child. Computed at the rate of 2½ percent a year, compounded annually, the total for the 18-year period comes to the considerable total of $2,000. The table below indicates that interest amounts to an outlay of many times that on account of mortality. The explanation is that a great majority of the deaths among children occur at the very beginning of life so that the expenditure for individuals thus lost is of brief duration and therefore not much in excess of the cost of being born. On the other hand, interest is cumulated over a period of 18 years.

To summarize, the total of all the items entering into the cost of raising a child in an American family of moderate income, on the basis of prewar prices, is close to $10,000.

This figure would be much higher if we added the value of the personal services of the mother. Had we a pecuniary measure of the value of her services, we should naturally include it in the estimate of the cost of raising a child. Unfortunately, such a measure is lacking and we can only call attention to the fact that it is normally a major item.

COST OF BRINGING UP A CHILD TO STATED AGES IN A FAMILY WITH AN ANNUAL INCOME OF $2,500

AGE	COST, EXCLUSIVE OF DEATHS AND INTEREST	ALLOWANCE FOR LOSS BY DEATH	ALLOWANCE FOR INTEREST ON EXPENDITURE AT 2½%	TOTAL COST
1	$643	$20	$12	$675
2	983	23	33	1,039
3	1,339	26	64	1,429
4	1,700	29	104	1,833
5	2,077	31	155	2,263
6	2,454	34	217	2,705
7	2,837	37	289	3,163
8	3,235	40	374	3,649
9	3,648	43	471	4,162
10	4,073	46	581	4,700
11	4,498	50	704	5,252
12	4,936	54	841	5,831
13	5,385	58	994	6,437
14	5,844	64	1,161	7,069
15	6,308	70	1,345	7,723
16	6,790	78	1,546	8,414
17	7,275	87	1,765	9,127
18	7,762	98	2,002	9,862

Death Toll From Burns at Record Low

FOR THE past quarter century the death rate from accidental burns (conflagration excepted) has been falling rapidly, with the result that deaths from this cause among Metropolitan Industrial policyholders are only about one fourth as frequent today as they were at the close of the first World War. In 1918, and for several years prior thereto, the death rate averaged around nine per 100,000 policyholders at ages 1 to 74 years, whereas for the three years 1940 to 1942 the rate has averaged only 2.3 per 100,000.

A variety of factors have contributed toward bringing about this marked and highly gratifying decline. Modernization of the American home, notably with central heating plants, gas and electric ranges, and electric lighting, has undoubtedly played an important part. Likewise, changes in feminine fashions have materially lessened the chances that women and girls will suffer a severe burn by clothing catching fire. Parents should be credited with the better care of children and with safer practices in the home. Aside from the saving of lives through the prevention of accidents, there is no question but that many persons who suffer severe burns are saved from death today because of the great advances made in the handling and treatment of such injuries. Still further progress may be expected from this source as physicians now in the armed forces gain wide experience in the treatment of war casualties.

The effect of some of the factors mentioned are clearly reflected in the reduction in mortality that has taken place in the various sex and age groups, as shown in Table 1. Both sexes shared in the decline between 1911–1915 and 1940–1942, but the drop was much greater for the females. As a result, the death rate from accidental burns (conflagration excepted) now is higher among white males than among white females, whereas heretofore it had been the one major type of accidental injury with a higher death rate for white females than for white males. Particularly encouraging has been the drop among children; at ages 1 to 4, where the highest death rates were recorded years ago, the drop in mortality was more than 80 percent for each color and sex group. The least gains were recorded for adult males.

Despite the sharply reduced frequency of deaths there are still far too many fatalities caused by accidental burns. In the general population of the United States, the death toll last year was considerably in excess of 5,000 lives. Thousands of persons, in addition, suffered serious and disfiguring injuries which did not prove fatal.

The death records of Metropolitan Industrial policyholders provide information on the chief agencies causing burns, and afford a number of clues as to where attention should

be especially directed to conserve life. Table 2 shows the percentage distribution of the agencies involved for four age periods.

Scalds resulting from hot liquids or steam accounted for nearly two thirds of the deaths among boys under 5 years of age and almost one half of the deaths among girls in that age group, who died from accidental burns (conflagration excepted) in the three-year period 1940 to 1942. Two types of accidents were largely responsible for these fatalities, namely, falling into a pail of hot or boiling water left on the floor at home, and upsetting a container filled with hot liquid. Accidents involving hot liquids and steam were considerably less frequent among adults than among youngsters, but the number of such accidents among men and women was nevertheless far from negligible. A sizable number of invalids or feeble persons are scalded when bathing or when taking a shower unattended.

Inflammable liquids figured prominently in the toll at all ages, except the very youngest and oldest. Such liquids were the leading agency and accounted for more than 30 percent of the deaths from accidental burns among insured men at ages 15 to 64 years, where occupational acci-

TABLE 1—BURNS (CONFLAGRATION EXCEPTED*). AVERAGES OF ANNUAL DEATH RATES PER 100,000. BY COLOR, SEX, AND AGE. AGES 1 TO 74 YEARS. METROPOLITAN LIFE INSURANCE COMPANY, INDUSTRIAL DEPARTMENT, 1911 TO 1915 AND 1940 TO 1942

AGE PERIOD, YEARS	DEATH RATES PER 100,000								PERCENT CHANGE 1940–1942 SINCE 1911–1915			
	WHITE				COLORED				WHITE		COLORED	
	MALES		FEMALES		MALES		FEMALES					
	1940 to 1942	1911 to 1915	1940 to 1942	1911 to 1915	1940 to 1942	1911 to 1915	1940 to 1942	1911 to 1915	MALES	FEMALES	MALES	FEMALES
1 to 74†	2.3	6.8	1.8	9.6	3.9	11.4	5.3	18.6	—66.2	—81.3	—65.8	—71.5
1 to 4	5.9	43.5	6.8	39.3	8.4	73.3	15.1	76.3	—86.4	—82.7	—88.5	—80.2
5 to 9	1.2	7.0	2.7	12.7	1.5	10.2	9.9	30.1	—82.9	—78.7	—85.3	—67.1
10 to 14	0.4	1.3	0.6	3.9	0.4	2.3	1.6	7.9	—69.2	—84.6	—82.6	—79.7
15 to 19	0.9	0.9	0.3	2.8	1.1	2.6	2.1	6.4	—	—89.3	—57.7	—67.2
20 to 24	1.3	1.5	0.7	3.6	2.4	2.7	1.4	8.0	—13.3	—80.6	—11.1	—82.5
25 to 34	1.7	1.7	0.8	3.6	2.8	3.6	1.4	5.5	—	—77.8	—22.2	—74.5
35 to 44	2.6	3.3	0.6	5.0	5.0	4.5	1.3	7.2	—21.2	—88.0	+11.1	—81.9
45 to 54	2.3	3.3	1.1	7.9	3.0	4.4	2.6	13.7	—30.3	—86.1	—31.8	—81.0
55 to 64	3.7	5.2	2.8	10.7	5.7	6.1	9.5	17.5	—28.8	—73.8	— 6.6	—45.7
65 to 74	8.8	8.2	7.5	24.5	20.1	20.8	34.9	46.9	+ 7.3	—69.4	— 3.4	—25.6

*Excludes also burns due to land and air transportation vehicles, machinery, mining and quarrying accidents.

†Standardized for age.

TABLE 2—BURNS (CONFLAGRATION EXCEPTED*). PRINCIPAL AGENCIES OF INJURY, BY SEX AND AGE. METROPOLITAN LIFE INSURANCE COMPANY, INDUSTRIAL DEPARTMENT, 1940 TO 1942

AGENCY OF BURNS	PERCENTAGE OF TOTAL DEATHS IN SPECIFIED AGE PERIODS							
	UNDER 5		5 TO 14		15 TO 64		65 AND OVER	
	Males	Females	Males	Females	Males	Females	Males	Females
ALL AGENCIES	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Bonfires	2.5	3.7	8.9	10.6	2.1	3.0	6.2	3.2
Lamps	—	0.7	2.2	—	1.7	1.3	3.7	2.6
Matches	5.9	12.5	4.4	16.3	1.4	0.4	9.8	2.6
Stoves and grates†	9.3	12.5	17.8	31.8	9.6	48.5	29.6	56.1
Hot liquids and steam	65.5	47.1	15.6	11.5	15.7	8.4	9.9	10.3
Molten metal	—	—	—	—	3.4	—	—	—
Hot objects	1.7	1.5	—	—	1.0	—	1.2	1.9
Corrosive substances	0.8	—	—	—	2.1	—	2.5	—
Inflammable liquids	5.0	5.8	37.8	10.6	30.5	16.9	5.0	5.8
Cigarettes, pipes, etc.	—	—	—	—	10.6	7.2	12.4	3.9
Other specified agencies	5.9	9.6	13.3	16.3	17.5	11.8	14.8	9.1
Type not specified	3.4	6.6	—	2.9	4.4	2.5	4.9	4.5

*Excludes also burns due to land and air transportation vehicles, machinery, mining and quarrying accidents.

†Does not include burns from kindling fires with inflammable liquids.

dents are numerically important. Gasoline explosions in commercial garages, in filling stations, and in junk yards where automobiles are dismantled, account for a large number of the fatal burns among men of these ages. Some men sustained fatal injuries in gasoline explosions while working on or near automobiles in the home garage. Among females at ages 15 to 64, about 17 percent of the fatalities resulted from the explosion of inflammable liquids. The practice of pouring gasoline or kerosene on the fire to light or hasten it along is the most frequent cause of accident in this category. In addition, many women are killed by burns suffered in the explosion of inflammable dry cleaning fluids used at home.

By far the most frequent agencies of accidental burns among women were stoves and grates, which accounted for one half of all the deaths from burns among adult females. A large proportion of these accidents occurred while the woman was engaged in some activity near the stove, although not actually at work over or tending it.

Careless smoking swelled the total of men and women who were burnt to death. More than one tenth of the fatalities among men were ascribed to this cause. Most frequently the victim had fallen asleep while smoking in bed. Women, too, to a surprising extent, are guilty of this foolhardy practice. Dozing off in a chair while smoking also caused a number of deaths.

Mortality Among Children With Rheumatic Fever

CHILDREN with rheumatic fever are subject to a very high mortality during the acute phase of the disease, but once this stage is passed the death rate falls sharply. These facts are brought out by a study of 2,817 policyholders of the Metropolitan Life Insurance Company under age 20 who received nursing care between 1936 and 1938 by the Company's Visiting Nurse Service during an acute attack of the disease, and were followed up each year since. This article covers the experience on this group of children from the time they received nursing care, up to 1942.

In this period, with an average duration of observation of nearly five years for the group as a whole, 257, or one out of every 11, have died. This mortality is about 15 times as high as would be expected in a group of young people of like sex and age distribution. The death rate among the boys has been about one fifth greater than among the girls.

The individual histories available for this study generally did not indicate whether the child suffered a first or a recurrent attack—an important factor in the prognosis. That the cases studied were of more than average severity may be inferred from their age distribution as well as from the fact they were ill enough to require nursing care.

Children who were definitely reported to have heart involvement during the attack for which they were nursed have had a much higher mortality than the other cases. In this group, containing less than one fourth of the cases in the study, there occurred 152, or nearly 60 percent of all the deaths. Since there is some degree of heart involvement in practically every attack of rheumatic fever, whether or not reported, it may be concluded that the cases in which a heart condition was actually reported represent the most severe in the study.

Mortality was especially high in the first year following the acute attack for which the children were nursed. Among those with reported heart involvement during the attack, nearly one fifth died in the first year. The actual death rate was 184 per 1,000 per annum, as compared with 23 per 1,000 in the second year, and an average of 16 in the subsequent period of observation. In contrast, a death rate of little more than 1 per 1,000 has prevailed among children of these ages in the general experience of the Company. Among the other cases nursed (those without reported heart involvement), the first-year death rate was 18 per 1,000, or only one tenth that of the group with cardiac involvement. In the second year of observation, the death rate in these other cases was 11 per 1,000, and in the remaining period it averaged 7 per 1,000. Even this rate is about five times the usual mortality.

Heart disease was reported as the cause of 80 percent of the deaths among the children in the study.

The majority of the cardiac deaths were due to rheumatic heart disease. Particular interest attaches to the high incidence of subacute bacterial endocarditis, a form of heart disease which is almost always fatal within a few months or years after onset. Although it accounts for an insignificant fraction of cardiac deaths in the general population, it is much more common in those who have had rheumatic fever. Among the children studied there were 26 such deaths, or 13 percent of the total from heart disease. Older children were principally affected, 21 of these 26 deaths being recorded among those 10 years or older at first observation, whereas only a little more than half of the cases in the study were in this age group.

Infectious diseases hold a grave risk for children who have had rheumatic fever. Not only are fresh attacks of rheumatic fever frequently preceded by upper respiratory infections, but there appears to be a lowered resistance to infectious diseases generally. This is shown by the fact that deaths from such diseases numbered 38, with 18, or nearly half, due to pneumonia. The number of pneumonia deaths alone is about as great as would be expected from all causes of death in a group of children of comparable sex and age distribution.

This study clearly indicates the seriousness of rheumatic fever in childhood. The disease is now a leading cause of disability and death at the school ages, and in adults up to middle life. These facts warrant the increasing efforts now being made to control the disease or to ameliorate its effects. Thus, for more than a year now, the Metropolitan Life Insurance Company has been conducting an extensive educational campaign among physicians, nurses, and the general public to promote prevention and early detection of rheumatic fever in children when much can be done to minimize permanent and serious heart damage. The U. S. Children's Bureau, working with State authorities for crippled children, has for the past four years been stimulating or intensifying programs for the care of children with rheumatic fever, under provisions of the Social Security Law, which makes funds available for this purpose. Research is under way on many phases of the disease, the cause of which still baffles the experts.

Despite the high mortality indicated by this study, it must not be thought that the outlook in rheumatic fever is invariably bad. On the contrary, a large proportion of the children that have suffered an attack escape serious damage to the heart and live normal lives. Even many whose hearts are impaired can lead active and useful lives if they stay within the limits that their physical condition requires. In fact, once the active stage of the disease requiring complete bed rest is clearly over, it is important that children resume activity suitable to their status in order to avoid or correct the psychological injury engendered by long periods of invalidism.

Comparative Data on the Causes of Death Among Industrial Policyholders

The following table shows the mortality among Industrial policyholders for October 1943 and October 1942, together with the death rates for the first ten months of 1943, 1942, and 1941.

DEATH RATES* PER 100,000 POLICYHOLDERS FROM SELECTED CAUSES.
WEEKLY PREMIUM-PAYING INDUSTRIAL BUSINESS
METROPOLITAN LIFE INSURANCE COMPANY

CAUSES OF DEATH	ANNUAL RATE PER 100,000 POLICYHOLDERS*				
	October 1943	October 1942	Year to Date: End of October		
			1943	1942	1941
ALL CAUSES—TOTAL	738.6	720.5	782.4	731.9	750.3
Typhoid fever	0.2	0.7	0.3	0.4	0.5
Measles	.3	—	.6	.5	.9
Scarlet fever	.4	.2	.4	.4	.4
Whooping cough	1.5	1.1	1.3	1.0	1.3
Diphtheria	.9	.6	.7	.5	.6
Influenza	2.2	2.3	5.3	4.1	8.4
Pneumonia (all forms)	22.5	22.2	34.9	28.7	31.7
Tuberculosis (all forms)	37.8	39.3	40.6	42.1	43.1
Tuberculosis of respiratory system	34.2	34.9	36.6	37.8	39.2
Syphilis	8.0	9.2	9.7	10.7	11.3
Cancer (all forms)	103.6	104.0	105.8	104.5	103.0
Diabetes mellitus	25.4	24.0	28.2	27.7	27.3
Cerebral hemorrhage	61.6	58.7	65.6	59.8	60.2
Diseases of the coronary arteries and angina pectoris	55.0	58.1	59.9	57.0	53.5
Other chronic heart diseases†	147.5	145.6	168.5	154.8	155.0
Diarrhea and enteritis	6.0	7.5	4.6	4.5	4.7
Appendicitis	4.3	5.4	5.5	5.9	7.5
Chronic nephritis	47.6	45.7	50.3	49.4	51.3
Puerperal state—total	3.3	4.7	4.3	4.5	4.7
Suicides	6.2	6.4	6.4	7.2	7.3
Homicides	2.2	3.0	3.2	3.7	3.6
Accidents—total	55.8	49.7	52.3	50.7	50.6
Home accidents	8.4	9.8	11.6	11.5	10.9
Occupational accidents	5.6	8.0	6.7	7.4	**
Motor vehicle accidents	15.7	15.7	12.5	17.1	20.5
War deaths (enemy action)	18.5	4.5	13.2	4.1	.3
All other causes of death	127.6	127.4	120.7	109.6	123.2

*The rates for 1943 are subject to slight correction, since they are based on provisional estimates of lives exposed to risk.
†International List (1940) titles 92, 93 (c), (d), (e), and 95.
**Not available.

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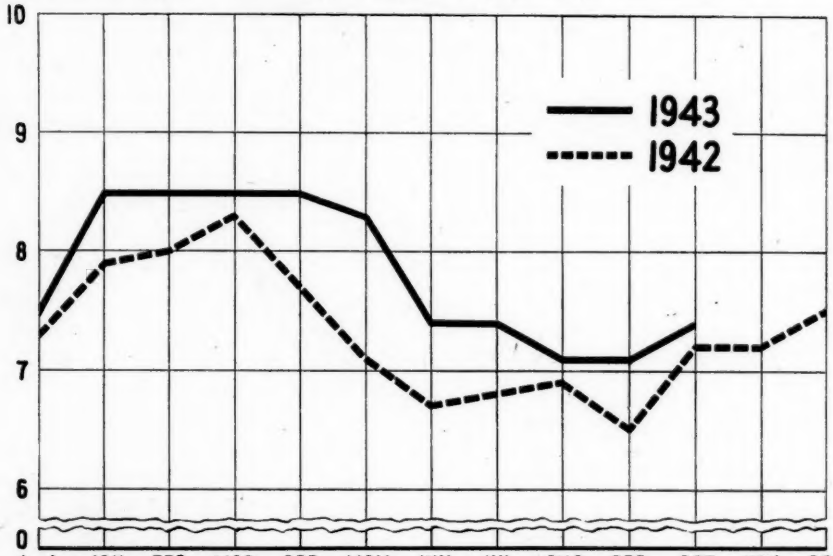
MORTALITY FROM ALL CAUSES

METROPOLITAN LIFE INSURANCE COMPANY
INDUSTRIAL DEPARTMENT, WEEKLY PREMIUM-PAYING BUSINESS

DEATH RATES PER 1,000 ANNUAL BASIS (*1943 figures are provisional*)



(DEC)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1942	7.9	8.0	8.3	7.7	7.1	6.7	6.8	6.9	6.5	7.2	7.2	7.5
1943	8.5	8.5	8.5	8.5	8.3	7.4	7.4	7.1	7.1	7.4		

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